State Tax Policy:
The Why and What of Economic Models

by
David G. Tuerck, Ph.D.

Dr. David G. Tuerck is Executive Director of the Beacon Hill Institute for Public Policy Research and professor and chairman of the Department of Economics at Suffolk University in Boaton, MA. His e-mail address is: dtuerck@beaconhill.org.

Economic models have a profound effect on taxing and spending decisions made by the Texas Legislature. Nevertheless, most policymakers and citizens are unaware of how such models can be used – and abused.

By every account, Texas is in the midst of a fiscal crisis. Writing in the *Dallas Morning News*, William McKenzie described the crisis in terms of a looming $5 billion 2003 deficit. According to McKenzie, the expected deficit leaves the state with no option but to "reform" taxes.

The only choice is how. The state could expand the franchise tax, expand the sales tax to include service professionals who are currently exempt, remove the prohibition on a state property tax, establish a business gross receipts tax, raise the sales tax on some items, or introduce a personal income tax. But, whichever path it takes, the state has to reform taxes. Said McKenzie, "Unless legislators change the state's tax code, they will continue to scramble for funds."[1]

[1] William McKenzie, "State Legislators Have Hard Choices," *Dallas Morning News*, February 19, 2002.

Tax reform, however, implies changes that go beyond the tax code. Whatever the justification for raising several billion dollars in revenue that would otherwise stay in private hands, a big change in the tax system can be expected to have a commensurately big effect on the economy. In order to contemplate tax reform, it is therefore necessary to be equipped with a method for assessing the economic changes that such reform is sure to bring about. For that task, policymakers need what economists call a "dynamic tax model."

Thinking About Taxes

Think about what it means when government changes a law that affects the taxes you pay or the taxes you might pay if you change your economic activity. Suppose, for example, that you live in Massachusetts, which has an income tax and a sales tax, and you're thinking about moving to Texas, which has a sales tax but no income tax. Now suppose that Texas decides to cut its sales tax and impose an income tax. That change in Texas tax policy would likely become a consideration in your decision to move there. If you are at the beginning of your career and have a young family, you might figure that now you're even better off moving to Texas, considering that you're in a low-income bracket and that the sales tax, wherever you might live, takes the bigger bite out of your household income. On the other hand, if you're further advanced in your career and in a better position to save, you might decide that the change in Texas tax policy would, on balance, reduce your standard of living.

Now think about the fact that if Texas changes its tax policy in this fashion, there are millions of people in Texas and elsewhere who will, in a similar fashion, reconsider their decisions about where to live. Texas workers, whose income taxes will rise, will likewise reconsider a decision to take a second job or to work longer hours. Texas consumers will consider buying another TV. And so forth.

An economic model is to a lawmaker what an architectural model is to a developer – a method of reducing the complexity of a decision to its essence.

This creates a complex problem for Texas lawmakers: Any new tax law sets in motion millions of changes in individual economic behavior that will affect, not only state tax revenues, but also the whole state economy. How can lawmakers identify the effects of these changes on indicators of state economic activity (tax revenues, jobs, living standards) that are of importance to them in framing state tax policy?

The answer is that they can do what an architect does in order to show the results of his detailed plans for a new building: Build a model. An economic model is to a lawmaker what an architectural model is to a developer – a method of reducing the complexity of a decision to its essence.

The developer needs to see what the building will look like and how it will permit the people using it to live or work. He doesn't need to see all the details that go into the construction of the building. The lawmaker wants to see how a new tax law will affect tax revenues, jobs and living standards. He doesn't need to know whether the new law will encourage a particular wage earner to move to Texas or encourage a particular Texan to buy another TV.

An economic model is therefore an indispensable tool for understanding how policy changes affect economic activity. Lawmakers need to know how the policy changes to which they are giving consideration would affect economic behavior and thus the well-being of taxpayers, consumers, workers, and businesses. An economic model is a must-have in the toolbox of government planners and lawmakers.

Lawmakers sometimes also want to know how past policy changes have affected the economy. They might wish to determine how a tax change enacted years ago affected the economy or how a proposed tax change not enacted would have affected the economy. For this also they need an economic model.

Static v. Dynamic Models

One clear implication of the foregoing line of thought is that tax-policy changes do invoke changes in individual, and, therefore, aggregate, economic behavior. It is impossible to make a change in anything as integral to individual economic behavior as tax policy without affecting that behavior.

As obvious as this is, the common practice in assessing tax-policy changes is to assume that tax-policy changes have *no* effects on economic behavior. The common practice is to assume that the Massachusetts wage earner considering a move to Texas would ignore the fact that moving there would now cost another thousand dollars a year in taxes. The common practice is to assume that lowering the sales tax on TVs would have no effect on a Texan's decision to buy a TV.

Static Models

"Models" employed to estimate the effects of tax-policy changes that assume away, in this fashion, the behavioral effects of tax changes are often called "static models." To illustrate, suppose a state that currently imposes a 5 percent personal income tax decides to raise the rate by one percentage point to 6 percent. Suppose that taxable income is $100 billion, so that the tax currently raises $5 billion in revenue (5 percent * $100 billion). Then, according to a static analysis of this tax change, the increase in the tax rate would raise new revenue in the amount of:

1. Old Revenue:
   0.5 * $100 billion = $5 billion.

2. New Revenue:
   0.6 * $100 billion = $6 billion.

3. Change in Revenue:
   New Revenue – Old Revenue
   = $1 billion.

The static model assumes that the tax-rate change has no effect on the tax base, and that revenue therefore rises in proportion to the tax-rate change. Revenue rises from $5 to $6 billion.

As the earlier example suggested, however, this conclusion flies in the face of reality. A tax change of this magnitude would be sure to induce changes in employment, wage rates, and other variables that would, in turn, change the tax base. If the tax base changes, it is illegitimate to apply the change in rate to the unchanged base, as in our above example, to estimate the effect on revenue. Rather than rely on static models that have this obvious deficiency, it is better to recognize behavioral changes when modeling tax changes.

Dynamic Models

Tax models that recognize behavioral changes are often called "dynamic" models. Such models recognize the fact that even a slight change in the tax system will change the financial choices of workers, consumers, and businesses. In the foregoing example, the increase in the income tax will encourage some workers considering a move to the state to remain where they are and will encourage some workers in the state to move out. Unincorporated firms whose profits are subject to the personal income tax will cancel expansion plans. Some workers will decide that, because of the extra 1 percent that will be taken out of their pay, it is no longer worthwhile to take a second job or to work extra hours.

...according to well-established and empirically-proven economic theory, a rise in the income tax can be expected to lead to shrinkage in work and therefore payrolls.

Indeed, according to well-established and empirically-proven economic theory, a rise in the income tax can be expected to lead to shrinkage in work and therefore payrolls. A tax increase that is levied on personal income causes workers to demand higher wages in order to maintain their standard of living. This makes labor more costly and causes employers to demand less labor. With fewer workers employed, the base upon which the income tax is levied decreases, resulting in a "dynamic" decrease in tax revenue.

Let us revisit our hypothetical tax change analysis, using a dynamic analysis. Recall that we are proposing to change the tax rate from 5 percent to 6 percent and are starting with a tax base of $100 billion. The above-described behavioral effects will make tax revenue smaller than that suggested by the static analysis.

How much smaller will depend on the sensitivity of people's economic decisions to the change in tax policy. Economists use the expression "elasticity" to denote this sensitivity. Through economic research, this elasticity is assigned a value. Suppose, for example, we determine that the elasticity of the personal income tax base to changes in the tax rate is 0.1. That is to say, a 1 percent increase in the tax rate will cause the tax base to shrink by 0.1 percent.

In our forgoing example, the tax rate rises by 20 percent (from 5 percent to 6 percent). Now applying the assumed elasticity of 0.1, the personal income tax base would shrink by 2 percent. In that case, revenue would increase, not by $1 billion, but by only $880 million:

4. Old Revenue:
   .05 * $100 billion = $5 billion.

5. New Revenue:
   .06 * ($100 billion – 2 percent
   * $100 billion) = $5.880 billion.

6. Change in Revenue:
   New Revenue – Old Revenue
   = $.880 billion.

This shows how static analysis leads policymakers to exaggerate the amount of revenue they can expect to get from a tax increase. Because, in this instance, the static model ignores the negative effect on payrolls, the tax base, and other elements of economic activity, it produces too large a revenue estimate. Our simple dynamic analysis reveals that the tax-rate change will bring in $120 million less in revenue than predicted by the static analysis.

The reverse holds true when static analysis is used to estimate the outcome of a tax decrease; static analysis overestimates the amount of revenue that will be lost from a tax cut. Just as people's economic decisions are affected by a tax increase, they react in the opposite fashion to a tax cut: work and payrolls expand. This expansion leads to more jobs and a dynamic increase in revenues as workers earn and spend more money. This dynamic increase works to offset the loss in revenues from the tax rate cut and diminishes the overall revenue loss.

Types of Dynamic Models

Dynamic models fall into various categories. One such category is called "econometric," while another is called "Computable General Equilibrium" (CGE). The "REMI" model developed by Regional Economic Models, Incorporated may be taken to represent a third category

All dynamic models consist of sets of equations that represent the underlying structure of the economy for which they are built. These "structural equations" consist of supply and demand relationships, accounting identities, and the inter-industry relationships that characterize the economy.

The principal differences lie in: (1) how these models arrive at the elasticities that link tax changes to economic changes; and (2) in the level of detail to which the model goes in aspiring to represent the underlying economy.

In building an econometric model, the economist finds the elasticities by assembling data and then estimating them, and applying statistical tools to the data. In building a CGE model, the economist finds the elasticities by determining which of several possible values make it possible to construct a model that closely mirrors the underlying economy.

Econometric Models

Econometric models are relatively simple and straightforward. The aim is to determine the effects of policy changes on a few, broad economic indicators.

An example of an econometric model is the Beacon Hill Institute State Tax Analysis Modeling

Program (STAMP[sm]). As an econometric model, STAMP applies statistical methods to a state database to estimate the tax-change elasticities and other elasticities that measure the sensitivity of economic activity to policy changes and other changes that affect the state economy.

In building an econometric model, it is necessary to test the estimated elasticities against certain theoretical and empirical standards. Does the elasticity have the right sign? (We would expect the elasticity linking income tax-rate changes to employment to be negative, so that a higher tax rate is predicted to reduce the number of jobs.) Is it statistically significant? (Is there only a small chance that the true elasticity is zero?)

In STAMP-type econometric models, the elasticities are estimated after the structural equations have been rearranged into a set of "reduced form" equations, in which the economic indicators explained by the model (employment, the stock of capital, and the wage rate) are expressed as a function of tax rates and other explanatory variables. The estimated elasticities are then used to construct a "simulation" spreadsheet that makes it possible to determine how hypothetical tax changes would affect these indicators.

CGE Models

CGE models are different in that they provide a much more detailed and literal description of the economy, and in that the elasticities are not directly estimated from the data. CGE models provide more detail, but are more difficult to interpret and harder to assess for robustness than econometric models. The aim of a CGE model is to provide as much detail as possible in identifying the effects of policy changes.

In CGE models constructed by the Beacon Hill Institute, the data are stored in three computer files: a social accounting matrix, a capital coefficients matrix, and a miscellaneous data file that has information including employment, tax incidence, and transfer payments. The social accounting matrix maps the main economic and fiscal flows in the economy. The capital coefficient matrix is a matrix of investments by industries. It contains distribution ratios of new structures and equipment to industries.

Because CGE models are so complex, it is impossible to estimate the elasticities directly from the data. The elasticities in the CGE model are based largely on the best judgment of the model builder. The economist tries different elasticities until, using optimization methods, it is possible to obtain a structural model that closely replicates the economy, as represented in the data matrices.

At the cost of this added complexity, CGE models offer a great deal more information about how policy changes reverberate through the economic system. Econometric models are tied to the historical data upon which they are based, and are limited to the analysis of how modest changes in existing taxes affect a few broad economic indicators. CGE models may be used to analyze radical changes in existing taxes or the introduction of new taxes for their effects on a wide array of economic indicators.

The REMI Model

A third type of model is the one developed by Regional Economic Models, Inc. (REMI). This model requires the integration of separate tax components into a single model that is later adjusted to assess new macroeconomic factors. Micro-level econometric estimates are determined and then integrated into the larger, interindustry model. Dynamic changes are assessed by applying proposed changes to the integrated macro model and recalculating the initial micro tax models with the resulting new values. Because of its construction, the REMI model analysis requires consecutive steps. One cannot estimate the macro dynamic effects without first estimating each separate underlying model.[2]

[2] "REMI Model Overview", Regional Economic Mod-

Dynamic Models in Use

The concept of dynamic modeling was developed as early as the 1920's, but was not put into use until the 1940's with the advent of computers. Dynamic modeling was first used for policy analysis at national levels. This stems from the broader reach of national economic policy and the greater availability of data at the national level. Countries for which dynamic models have been built include Australia, Denmark, Norway, France, Germany, Nepal, Cameroon, Nigeria, Kenya, and the United States. Economic models of trading regions, including NAFTA and the European Union have also been constructed.[3]

There is ongoing consideration of employing dynamic modeling at the federal level, but no consensus has been reached on this point as of yet.[4] The U.S. Congress does not currently use dynamic modeling in the preparation of revenue estimates or proposed tax change analyses. According to Congress' Joint Committee on Taxation, analysts use static micro-simulation models, similar to a tax calculator, to determine the effects of a tax change on the various income tax brackets. Their analysis does use the results of this static analysis to determine the movement of populations among income brackets based on tax-change driven behavior. It does not however, take into account changes in employment levels that are considered in a dynamic analysis.

Michigan and Texas have been among those states considering an increased reliance on dynamic modeling for analyzing policy changes.

At the state level, construction and use of dynamic models is a relatively recent enterprise. The principal reasons for the reluctance to apply dynamic modeling at this level are the relative unavailability of data and a slowness to recognize the importance of policy changes to state economic activity – an anomaly insofar as state-level tax changes affect the competitiveness of states more acutely than national-level tax changes affect the competitiveness of nations.

Few states have yet recognized the importance of dynamic modeling of policy changes. An exception is California, which mandated the use of dynamic modeling and built a Computable General Equilibrium model in 1995.

Since most states have not mandated dynamic modeling, its use at the state level remains rare. Massachusetts has a REMI model modified in 1992 by Price Waterhouse. Due to criticism and dissatisfaction with the model's results by the state Legislature, use of the Massachusetts model appears to be limited.[5]

Several other states, including Minnesota, Florida, Texas, Arkansas, Connecticut, Delaware, Wisconsin, Kentucky, and Pennsylvania, use REMI models. Michigan and Texas have been among those states considering an increased reliance on dynamic modeling for analyzing policy changes.[6]

eling Incorporated, available from: http://www.remi.com.

[3] An extensive list of economic models in use around the world can be obtained from http://www.unibw-hamburg.de/WWEB/math/uebe/modelle/.

[4] Tom Koernar, Associate Deputy Chief of Staff, Joint Committee on Taxation, phone interview, February 25, 2002.

[5] "Dynamic Revenue Estimating: Will it Work For Michigan?," Joint Report of the Michigan House Fiscal Agency, Senate Fiscal Agency, Department of Treasury, March 1997.

[6] "Dynamic Revenue Estimating: Will it Work for Michigan?" and Texas Comptroller of Public Accounts, "Dynamic Modeling: New Method of Tax Analysis Accounts For Taxpayer Behavior," *Fiscal Notes*, April 1999.

Results of State Dynamic Models

Although many state dynamic models were built for analysis of specific projects and policy changes, there are some "general" results that can be presented from state dynamic models.

Sales taxes considered by dynamic models tend to have a common dynamic feedback effect of 5 percent to 7 percent. That is, given a sales tax increase, 5 percent to 7 percent of the expected revenues as determined by static analysis would be lost due to dynamic feedback effects in the state economy. For example, in California, the CGE model determined that if the state cut the sales tax rate so as to decrease revenues by $1 billion, the actual resulting decrease would be about $932 million after feedback effects. In Massachusetts, similar effects in dynamic modeling resulted in a loss of 4.9 percent of the anticipated static revenue change.[7]

Personal income tax changes commonly have a low dynamic feedback effect in state dynamic models, typically around 1 percent. The California model determined an effect in this range. Surprisingly, however, the Massachusetts model determined a much stronger feedback effect of 6.4 percent.

In dynamic modeling, taxes on businesses tend to have relatively high feedback effects. The results of two major conferences organized to discuss state dynamic modeling (in Michigan in 1997 and in Texas in 1999) showed that existing models indicate feedback effects ranging typically from 10 to 18 percent for business taxes. The Massachusetts model showed the most significant results with a dynamic feedback effect of 30.4 percent.

The important concept to remember in looking at these apparently small percentage changes, is that each dynamic feedback effect is a percentage change in jobs, wages, population in the state and the numerous other variables that represent a broad swath of economic activity.

There is one final consensus of state dynamic modeling, which is to say that dynamic feedback effects take time to realize. Authors of the existing state models contend the process of feedback effects filtering throughout the economy may take five years or more. The most noticeable effects likely occur when corporate taxes change.

The Beacon Hill Institute's Experience with Dynamic Modeling

BHI has been constructing dynamic models since it first developed and applied its State Tax Analysis Modeling Program (STAMP[SM]) in 1994 in Massachusetts. Constructed to analyze a proposal to institute a graduated income tax structure in Massachusetts, the results supplied by Massachusetts-STAMP contributed to the proposal's overwhelming rejection at the polls.

Massachusetts-STAMP helped thwart a 1999 proposal to raise the state's capital gains tax. In one publication, circulated among legislators who sustained the governor's veto of the proposal, Massachusetts-STAMP showed that an increase in the capital gains tax would have a two-fold harmful effect: first, it would impose the highest tax rate increase on the lowest-income tax filers; and second, it would lead to the destruction of millions of dollars in business capital. In 2000, Massachusetts-STAMP showed the economic gains of a proposal to lower the state's personal income tax rate from 5.85 percent to 5 percent. Voters approved the proposal that November.

---

7 Alan Clayton-Matthews, "The Massachusetts Dynamic Analysis Model," *State Tax Notes*, Volume 5, Number 12, September 20, 1993.

Including the Massachusetts model, BHI has constructed 15 STAMPs that have been applied to numerous proposed tax-law changes across the country. Among the STAMPs that have been constructed, many, including the Texas-STAMP, were for policy groups that belong to the State Policy Network, a group of think tanks mainly devoted to policy analysis at the state level. Arizona-STAMP, Michigan-STAMP, New York-STAMP and Pennsylvania-STAMP, were all completed in 2000 as the results of a strategic partnership between the Beacon Hill Institute and the Heritage Foundation. Among those, Pennsylvania-STAMP has been the most widely influential in the press and in policy. In May 2001, the Commonwealth Foundation used this model to produce *Taxing Electronic Commerce in Pennsylvania: What Legislators Should Know*, in response to proposed legislation affiliating Pennsylvania with a national effort to tax internet sales. The Commonwealth Foundation is slated to use the model to analyze a proposed phase-out of the corporate income tax.

Among the STAMPs that have been constructed, many, including the Texas-STAMP, were for policy groups that belong to the State Policy Network…

In 2001, BHI built a Maryland-STAMP to assess a proposed universal health care measure. Maryland-STAMP was developed through a partnership with the Heritage Foundation and Maryland-FREE (Foundation for Research and Economic Education). In 2001, BHI also built its first city-based STAMP for the Manhattan Institute. New York City Mayor Rudy Giuliani used the results of NYC-STAMP to highlight the job-creating effects of tax cuts enacted under his administration.

Development of Texas-CGE STAMP

With an understanding that state taxes exert important effects on state economic activity, and recognizing the significant advantage and importance of dynamic modeling, the Texas Public Policy Foundation asked BHI to develop a CGE model for Texas. This CGE model is designed to allow TPPF to assess anticipated proposals that would cause sweeping changes in state tax policy.

One task assigned the model was to determine the economic effects of a major restructuring of state tax policy. The tax change was assumed, specifically, to consist of the imposition of a state personal income tax combined with a simultaneous cut in the sales tax. The tax change was to be "revenue neutral," so that the revenue lost by cutting the sales tax would be exactly matched by revenue gained from the new income tax.

Texas-CGE STAMP has 64 sectors; each is an aggregate that groups together segments of the economy. The model separates households into seven income classes and firms into 25 industrial sectors. In addition, it distinguishes between 17 types of taxes (10 of them at the state level) and 10 categories of government spending. To complete the model there are two factor sectors (labor, capital), an investment sector, a Texas "general fund" sector, and a sector that represents the rest of the world.

Among the variables determined by Texas-CGE STAMP are: household disposable incomes, private consumption expenditures, household savings, various consumer price indexes, labor supply, migration, population, number of working and nonworking households, trade with other states and countries, net capital inflow, investment, capital stock, gross investment by sector of destination, tax collections, government income, government purchases of goods and services, government savings, state personal income, and real gross state product (GSP).

The model shows that if the state were to cut its sales tax in half and if the revenue thus lost were replaced with a new graduated income tax, Texas would lose 73,000 jobs. Further, there would be a net in-migration of 121,000 residents. Real gross state product would increase by $.4 billion, though, because of the increase in population. Per capita real GSP would fall by more than 0.5 percent, or almost $180 per capita. The tax change would also result in a significant increase in pre-tax nominal wages and in investment.

This simulation is certainly not the only application of Texas-CGE STAMP. The advantage of having a model, especially a CGE model, is that it permits the user to consider a wide variety of possible tax changes.

A suitably constructed dynamic model, whatever its design or origin, makes the difference, in any event, between informed and uninformed policymaking. No developer could understand the architect's plans without first seeing a scale model. Likewise, no policymaker could understand a change in tax policy without seeing what a model, conceived and tested according to the standards of economic science, shows about that policy change.

A suitably constructed dynamic model, whatever its design or origin, makes the difference, in any event, between informed and uninformed policymaking.

✯✯✯