# State Economic Development Incentives Under Interstate Retaliation

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Abstract

Many American states use firm-specific tax abatements in an attempt to attract and retain businesses. Since approximately 1990, the "war among the states" for economic development has intensified. This paper analyzes Ohio's job tax credit program using a state-level computable general equilibrium (CGE) model that accounts for economic and fiscal flows within the Ohio economy. The model also links Ohio and the rest-of-the-United States through labor market and goods market flows. We estimate that net job creation due to the Ohio program is nine percent of the number of promised new jobs if other states do not retaliate with similar tax abatement programs. If other states retaliate, we estimate that Ohio's net employment will expand by less than one percent of the promised new jobs and the state government deficit increases by $100 million annually.

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**State Economic Development Incentives Under Interstate Retaliation**

Competition for economic development is more intense now than ever before among states and localities in the United States. Rivalry is inevitable since state and local governments are semi-autonomous in their relations with each other and with the federal government. There are 50 state governments and approximately 40,000 general-purpose local governments within the American federalist system (Kenyon and Kincaid, p. 7). These sub-national governments compete in ways that may affect the location of firms. A variety of economic development incentives, including tax-abatements, infrastructure investments, concessionary loans and special services (such as job training), are utilized by state and local governments to attract new businesses and to retain existing businesses.

The traditional view of economists is that tax abatements are an ineffective instrument for job creation. Empirical studies in the 1960s and 1970s found little evidence that business taxes influence the location of firms; in most statistical studies of incentives, the output or employment elasticity of taxes was statistically insignificant. Furthermore, economic development incentives are often viewed by economists as a form of rent-seeking on the grounds that a large share of the benefits of local growth accrue to immobile factors of production, such as land and buildings, which are owned disproportionately by well-endowed and powerful elites. Mainstream economic opinion, based on the assumption that most factors of production are perfectly mobile while land and buildings are perfectly immobile, dismissed economic development incentives on both efficiency and distributional grounds (Due).

Recent regional economic research calls into question the traditional view that taxes have no effect on business location. Since 1980, numerous econometric studies have obtained

statistically-significant tax elasticities, though the magnitudes of the elasticities are generally relatively small. For example, Bartik (1991) reviewed 57 econometric studies conducted since 1980 and found that in 70 percent of the studies at least one tax variable was negative and significant in explaining business location. A 1995 study of state employment growth over the period 1970-1990 obtained a negative tax elasticity that is robust with respect to model specification, including model variants that control for state-level fixed effects and public service differentials (Partridge and Rickman).

This paper evaluates an economic development incentive program initiated in Ohio in 1992. A regional computable general equilibrium (RCGE) model of the Ohio economy is utilized to evaluate the Ohio Job Creation Tax Credit (OJCTC) program under alternative assumptions about retaliation by other states. The model incorporates several features that are particularly important in modeling the highly-open state-level economy: (1) investment is determined by the user cost of capital rather than by the state's "domestic" supply of savings, (2) labor migrates in response to changes in the real wage rate in Ohio relative to the rest of the United States, and (3) government is disaggregated into federal, state, and local units. Because of the decoupling of savings and investment and the regional mobility of investment and labor, our model differs significantly from national-level CGE models.

**The Policy Issue**

The Ohio Job Tax Credit Program, created by the General Assembly in 1992, authorizes the state government to reduce the state corporate income tax liability of new or expanding firms.

In 1993, the first year of the program, the Ohio Tax Credit Authority approved tax credits to approximately 85 firms that promised to create 10,371 new jobs.

Economic development incentives have several well-known defects: they may induce capital-labor ratios that are inconsistent with opportunity costs; and they may lead to zero-sum competition that simply shifts economic activity among the states. On the other hand, the job tax credit is a potential improvement upon other state tax incentives as an instrument of job creation. The Ohio program encourages an increase in labor usage as well as capital usage by reducing the state corporate income (profit) tax paid by selected business firms in exchange for jobs created by those firms. A firm that participates in the Ohio program is allowed to retain up to 100 percent of the personal income tax withheld from paychecks of new employees as a credit against the firm's corporate income tax liability for a period of up to 10 years. In practice, abated taxes in the Ohio program have varied between 20 and 75 percent of a firm's withholding tax liability on the income paid to new workers. It is widely recognized in the public finance literature that capital taxes have both output and substitution effects: lowering the price of capital may increase employment as more capital is attracted by lower capital taxes. Under some circumstances, however, the substitution of now-cheaper capital for labor may reduce employment (Harberger, Mieszkowski). Whether the output effect or the substitution effect dominates depends on the capital-labor ratio, the marginal rate of substitution between labor and capital, and the supply elasticities of labor and capital. By tying the corporate tax abatment to employment increases, the Ohio program avoids or at least minimizes the substitution effect.

The effectiveness of the Ohio job tax credit is dependent, in large part, upon whether other states adopt similar measures. In a federal system, the benefits of any type of economic

development incentive may be less than anticipated. Mimicry in economic development programs is common among the states, and innovative programs spread rapidly throughout the country. In creating the job tax credit program, Ohio legislators argued that the neighboring state of Kentucky, which began offering job tax credits in 1989, was enticing Ohio firms to move across the state border and that a similar program was needed to retain existing firms. Since Ohio launched its tax credit program in 1992, similar programs have been initiated by Alabama, South Carolina, Georgia, Florida, and Indiana. If tax credits are truly effective in increasing employment and stimulating investment, it is likely that programs in other states could cause enough outmigration from Ohio and enough reduction in national prices of some products that benefits in the state would be eliminated or greatly reduced.

Proposals to curtail interjurisdictional competition for economic development include multilateral voluntary restraints, prohibition by federal mandate, use of "clawback" contracts that require firms to reimburse governments if employment targets are not met, and public disclosure of estimated costs of economic development incentives (Kenyon and Kincaid, p. 3). Voluntary restraints have proven impossible to enforce. Efforts to pass federal mandates regulating interjurisdictional competition have been successfully resisted by the states, though the U.S. constitution prohibits state tariffs. Clawbacks have been adopted recently by some states, but experts question whether such contracts can be monitored and whether they are legally enforceable. Among these proposals, public disclosure of estimated costs and benefits appears to be the most viable solution in the current environment. Unfortunately, most states lack methods for evaluating the effects of job tax credits and other economic development incentives.

**The Contribution of CGE in Evaluating Economic Development Policies**

Previous studies of economic developmment policy impacts have used econometric estimation, cost-benefit analysis, simulation, and computable general equilibrium analysis.

An advantage of econometric analysis is that goodness-of-fit measures and confidence intervals are available. Regional policy issues that have been addressed recently using econometric methods include the growth effects of taxes (see survey in Bartik, 1991) and the regional impacts of infrastructure (Munnell; Crihfield and P.H. Panggabean). Econometric methods have two serious limitations, however, for regional policy analysis. Samples of sufficient size for estimation of structural econometric modeling are often unavailable at the regional level. Furthermore, econometric estimates of impacts can only be generated after the policy in question, or a similar one, has been implemented.

Rasmussen, Bendick, and Ledebuhr (1982,1984) and Ledebuhr and Hamilton (1986) used cost-benefit (CB) analysis to evaluate the impacts of economic development grants and loans. They found the cost to the government of providing incentives exceeded the benefit to the firm for every type of subsidy except loan guarantees. A drawback of CB analysis is that the standard valuation procedures are based on the assumption of perfect factor mobility. CB procedures for situations in which factors are not perfectly mobile are not well-developed, since a different general equilibrium model would have to be developed for each situation.

Papke and Papke, using a simulation model (AFTAX) for Indiana, found benefits for Indiana's enterprise zone programs that exceeded those reported by Rasmussen, Bendick, and Ledebuhr. In their study, the Papkes calculated a tax abatement break-even point to guide program officials in negotiating with firms. While the Papke study has considerable detail in its

tax module, it does not attempt to model the rest of the economy surrounding the project (in this case, enterprise zones) and thus ignores potentially important feedbacks from the economy.

Rickman utilized a two-region computable general equilibrium (CGE) model of the United States in a stylized analysis of elimination of regional (primarily state but also some local government) corporate income taxes. The analysis focused on alternative model closures and the effect these have on model results. His model was an improvement over previous studies of economic development incentives because it accounted for the following factors: constrained regional factor supplies; intergovernmental tax deductibility; regional and federal government expenditure and transfer policies; and resident ownership of factors of production. Rickman found that complete elimination of regional corporate income taxes resulted in increases in regional value-added ranging between 0.41 (when a "pure" neoclassical closure is used) and 3.41 percent (when a "pure" Keynesian closure is used).

Key advantages of the CGE framework include the following: it permits the analyst to adopt a range of factor mobility assumptions, rather than the polar assumptions of perfect mobility or complete immobility; it can be implemented with small data samples; it can capture the feedback effects of policies (such as tax abatements) on both firms and governments; and it can incorporate feedback effects from other regions in response to the policies of any particular region.

**The Ohio Computable General Equilibrium Model**

The CGE model presented below is designed to reflect the economic circumstances and behavior of a state economy in a federal system. The model is relatively more open with respect

to flows of commodities, factors of production, income, and savings than national-level CGE models. The model has the following key features:[1]

1. Households maximize utility and firms maximize profits. Prices and supplies of all commodities and factors of production are determined endogenously. The interaction of endogenous prices and quantities implies that the ratio of basic (export) output to nonbasic (non-export) output is variable.[2]

2. The level of net sectoral investment is driven by the endogenous user cost of capital (which is influenced by fiscal policy and other factors) relative to the benchmark cost of capital in each industry.

3. At the aggregate level, the total supply of investible funds is determined by the profitability of regional firms, not by indigenous savings. Regional savings deficits are financed by savings inflows (bank loans, money market transactions, federal government transfers, or corporate debt or equity) from the rest-of-the-United States (ROUS). Regional savings surpluses represent an outflow from Ohio to ROUS. Because the nation has a single currency, these flows occur at a fixed exchange rate.

5. We capture interregional feedback effects by constructing a labor market and a goods market in the rest-of-the-U.S. (ROUS). This approach captures essential linkages among the regions without explicitly incorporating interregional trade in intermediate goods.

7. The model is solved for a long-run, static equilibrium in which capital stock and labor supplies are endogenous and investment multiplier effects are incorporated.

Figure 1 depicts relationships among the economic agents and accounts in the Ohio CGE model. The shadowed boxes represent economic agents (industries, households, and governments). Solid lines represent real flows (industry output, commodities, labor) while dotted lines represent nominal flows (income, expenditures, and taxes). In addition to showing relationships within the state, the diagram reveals how the state economy is linked to the rest-of-the-U.S. in the model.

*Production*

There are two commodities: one is a good, the other is a service. The good is traded in national and international markets and therefore has a relatively high trade-substitution elasticity. The service is also traded, but to a lesser extent, and therefore has a lower trade-substitution elasticity than the good. Both the goods and service industries purchase intermediate inputs, labor, and capital at levels that maximize profits. Intermediate and primary inputs are combined in price-responsive, variable proportions using translog technology.

*Factors of Production*

Labor in the model is partially mobile. Workers migrate to the region (either Ohio or ROUS) with the highest real wage rate, determined by a wage rate-migration elasticity. Using econometric procedures, we estimated the Ohio wage rate-migration elasticity to be 0.2 over the period 1970-90.[3]

Installed capital is assumed immobile in our model, though the stock of capital is adjusted to account for both depreciation and investment. The supply of capital in each industry is

determined by the benchmark level of capital stock, the depreciation rate, and the level of net investment. Net investment is driven by the cost of capital, a variable based on the marginal value product of capital and on policy parameters (in this study, the corporate income tax rate). Theoretical foundations of the cost-of-capital approach to investment determination are elaborated in Jorgenson and Yun.

*Households*

A representative household earns income from labor and capital services and from government transfers. Savings out of gross income is determined by a constant average propensity to save. Income tax is paid to state and federal government according to average tax rates estimated from flows in the base year data. Disposable income is spent on the two private commodities in the model in a manner that maximizes utility subject to a household income constraint.

*Governments*

The local government collects indirect business taxes (primarily excise and property taxes) and personal income taxes and receives intergovernmental transfers from the other two levels of government. It also purchases goods and services from the private sector and makes transfer payments to households and to the other two levels of government. Total real spending by the local government is fixed, though the flexible structure of the model would readily permit it to be made endogenous.

The functions of the state government are similar to those of local government. In addition, however, the state government receives corporate income tax revenues. Total real spending by state government is exogenous.

The federal government collects personal income tax, corporate income tax and social security payments. Tax deductibility is incorporated: state corporate income tax paid by Ohio firms is a deduction against corporate income tax payments to the federal government. The level of real federal spending in Ohio is exogenous. Federal revenue in excess of federal spending is treated as a leakage from the state.

*Rest-of-the-United-States (ROUS)*

ROUS consists of six other states aggregated into a single region: Kentucky, Alabama, South Carolina, Georgia, Florida, and Indiana. These are the other states that have recently launched job tax credit programs similar to the one in Ohio. ROUS maintains a pool of labor for which the wage rate is determined by demand and supply in both regions. It also purchases Ohio's exports. The quantities and prices of these imports in ROUS are endogenously determined through the interaction of supply and demand.

**Data**

A social accounting matrix (SAM) of the state of Ohio was prepared by Minnesota IMPLAN for 1990. An aggregated version of the SAM is presented in Table 1. Sources of data for the SAM include economic censuses conducted by the U.S. Bureau of the Census, County Business Patterns, the Employment Security (ES-202) series, the Gross State Product series, the

quinquennial national input-output accounts, the annual national input-output accounts, and other federal statistical data series. Fiscal data used in the model were obtained from various reports issued by the Ohio Department of Taxation.

**Model Simulations**

The Ohio job tax credit reduces the corporate income tax liability of participating firms. The amount of the tax credit is calculated by the state as a percent of new employees' withholding tax (i.e., income tax that the firm withholds from the new workers' paychecks as required by the state tax code). The Ohio Job Creation Tax Credit Authority (OJCTCA) grants tax abatements up to 100 percent of the new employees' withholding tax for up to 10 years. The tax credit is granted primarily to manufacturing firms.

The experiments below simulate the combined effect of 85 job tax credit projects approved by the OJCTCA in 1993. The term of the tax credit was 10 years in 80 percent of the projects. Firms have to certify that the jobs are new to qualify for the tax credit. An insurmountable information asymmetry between firms and government agencies makes it impossible for economic development agencies to accurately monitor the "additionality requirement" of employment- or investment-based subsidies (Swales). The recipient firms in 1993 promised to create a total of 10,370 new jobs.[4] In the discussion that follows, a "project" refers to each business establishment that received the tax credit in 1993 and the jobs that firms promised to create are referred to as "project jobs".

*The modeling scenario (direct impact) consists of an annual abatement of $47 million in the corporate income tax liability of the goods-producing sector.* The tax credit is tied directly to

wages paid to new employees. For this reason, the credit is treated in the model as a wage subsidy accruing to project firms, effectively lowering the wage costs of each additional worker. The variation across the experiments reported below lies in alternative assumptions about whether other states implement similar tax credits.

*Experiment 1: Job Tax Credit in Ohio with No Retaliation in ROUS*

Description: In this experiment, the scenario described above is introduced under the assumption that other states will not implement tax abatements in response to the Ohio program. The assumption is operationalized by making ROUS wages and the ROUS price of Ohio's exports exogenous in the rest-of-the-United States (ROUS).

Results: We estimate that the job tax credits granted in Ohio in 1993 generated net new employment of 938 jobs (see Table 2). The estimated net jobs gain is far lower that the 10,371 new jobs that the project firms promised to create, suggesting that the tax credit program induces a great deal of job shuffling. Our model estimates that employment increases by 4,580 (0.28 percent) in the goods-producing sector but decreases by 3,643 (0.09 percent) in the service-producing sector. The tax credit-induced expansion in the goods-producing sector pushes up the wages that employers are willing to offer in that sector and draws labor out of the service-producing sector.

Because many of the new jobs substitute for existing jobs, the multiplier effect of the tax credit is relatively small. If the promised new jobs are interpreted as the "direct" effect of the tax credit program, the implied employment multiplier is .09 (938/10,371).[5,6]

As a result of the wage subsidy, real gross regional product (RGRP) increases by 0.21 percent ($498 million) annually. Net investment rises by 1.91 percent ($304 million) in the goods-producing sector. Though the service sector does not receive a direct subsidy, its investment increases by 0.95 percent ($138 million) because of increased demand for its output as an intermediate input in the goods-producing sector and as a final product purchased by consumers who now have more income. The increase in demand for services raises profits in that sector, even though the wage subsidy occurs in the other sector and stimulates higher investment. For the state as a whole, net investment increases by 1.45 percent ($441 million).

The intersectoral effect of the tax credit in the goods-producing sector is rather complex. While employment declines in the service sector, output in that sector increases for two reasons. First, the rising wage leads to substitution of capital for labor (i.e., the capital-labor ratio rises) which partially mitigates the decline in employment in that sector. Second, the rise in intermediate demand (due to the increase in service usage by the expanding goods-producing sector) and the rise in final demand for services (due to the increase in household incomes) causes the price to rise in that sector, stimulating an output increase.

Exports rise by 0.72 percent ($954 million) in the goods-producing sector because Ohio's goods are now somewhat less expensive in national and international markets as the tax credit effectively reduces the wage costs of Ohio firms in this sector. In the service-producing sector, exports rise by 0.29 percent ($173 million) as service firms are now able to purchase Ohio-produced goods at a slightly reduced price, thus lowering the cost of producing services. This reduction in the cost of inputs of the service sector is due to the lower transportation and

transactions costs of intermediate goods produced in Ohio compared to those produced outside the state. Summed across sectors, Ohio's exports increase by 0.59 percent ($1127 million).

Annual wages per worker rise by 0.55 percent ($141) in Ohio following the introduction of the job tax credit. Wages rise because of the increased demand for labor, leading to a labor supply response of Ohio residents and of outside workers (in-migrants). An additional 746 workers migrate into the state in the long-run, while an additional 192 previously unemployed Ohio residents gain employment.[7]

State government revenue decreases by a small amount ($11 million, a reduction of 0.05 percent) after accounting for the direct annual tax credit of $47 million granted to project firms. Nominal government expenditures increase by $38 million because of a slight increase in the market price of services in the Ohio economy as a result of the abatement-induced increase in output in the goods-producing sector.[8]

*Experiment 2: Job Tax Credit in Ohio with Retaliation by Other States*

Description: In this experiment, other states are assumed to relatiate by implementing tax credit programs similar to the Ohio program. This "copycat" behavior is implemented in the model by endogenizing the wage rate and the price of traded goods in the rest-of-the-U.S. In the labor market, the model now allows wages in the rest-of-the United States to rise to the level of Ohio wages under the assumption that tax credit-induced output increases in other states result in similar wage pressures. This endogenous wage response in other states causes net migration to remain at its benchmark level in Ohio, therefore curbing the expansion in output in the state. The goods market price falls in ROUS in response to the increased output in that sector in both Ohio

and ROUS until a new equilibrium national goods price is established. This endogenous response in the price of goods further curbs the expansion in Ohio.

Results: The increase in real GRP in Ohio is now only $72 million, as shown in Table 3. This is only 14 percent of the increase in real GRP that occurs in experiment one (which assumed no retaliation by other states). In the goods-producing sector, industry output, exports, and employment now increase much less than when there is no retaliation by other states (compare Table 3 with Table 2). In the service-producing sector, output falls now. The dampening effect of the labor transfer from the goods-producing sector to the service-producing sector is no longer outweighted by the expansionary effect of intermediate demand from the goods-producing sector. The output increase in the goods-producing sector is simply too small now to generate enough intermediate demand to maintain service sector output at its benchmark level.

Employment rises by 522 (0.03 percent) in the goods-producing sector in response to the tax credit while 476 workers move out of the service-producing sector. As before, much of the employment expansion in the goods-producing sector is made possible by workers moving out of the service-producing sector. An important difference now, however, is that output in the service-producing sector declines in experiment two. As other states implement job tax credit programs, output and demand for labor rise nationally in the goods-producing sector. The increase in output in ROUS lowers the price in national markets and curbs the output expansion in Ohio. Furthermore, the national expansion induced by tax credits in other states means that Ohio is no longer able to bid labor away from other parts of the country. Employment now increases in Ohio by a small amount (46 workers). The employment multiplier is now extremely small (46/10,371 = 0.004).

The net fiscal benefits to state government are now negative. Revenues fall by $100 million when other states imitate the Ohio job tax credit. State government expenditures rise slightly but by less than a million dollars. On balance, then, the state government suffers a net fiscal loss of $100 million.

**Conclusions**

The "tax abatement war between the states" has now escalated to the point where firms searching for industrial sites can expect to receive tax-break offers from a large number of state and local governments seeking to attract jobs and to increase their tax rolls. State and local governments argue that, although they may not like the tax incentive approach to economic development, they cannot "unilaterally disarm." This paper focuses on Ohio, an early entrant in the job tax credit game in the 1990s. Our analysis indicates that Ohio probably experienced short-term employment and output gains from its Job Tax Credit Program since it was one of the first states to adopt such a program. We also show, however, that after a number of other states implemented similar tax abatement programs, the gains to the Ohio program likely diminished greatly. Though the state economy gains slightly in value added even under retaliation, the gain is small and the state government experiences a net annual fiscal loss due to the tax incentive program when other states implement similar programs. Ordinarily, such a fiscal loss is hidden in the myriad changes in the state economy and is difficult to identify. The advantage of our general equilibrium analysis is that we are able to hold other factors (e.g., national economic conditions, the secular decline in goods-producing sectors, federal budget cutbacks, or shifts in foreign export demand) constant and focus on the net effects of the tax incentive program.

The policy implication of our analysis is that there may be gains to an early aggressor in tax abatement contests, but that the benefits are likely to soon diminish to the point where the sponsoring government may suffer a net fiscal loss. Under such circumstances there would be good reason for states to seek to discourage tax breaks for economic development. None of the proposed solutions, including voluntary agreement among states to reduce the use of tax abatements or congressional action banning tax abatement appear to offer easy answers to the problem. Until now, there have been relatively few attempts to quantify the effects of tax abatements using regional economic models. The general equilibrium model presented in this paper measures the multiplier effects of economic development policies in a way that accounts for every worker in the model, thereby avoiding the over-estimation that is common in conventional multiplier analysis. Our findings suggest that, after accounting for all the benefits and costs, the current job tax credits offered by many state governments probably do little more than retain the existing laborforce in those states and that there would be gains to all state governments in identifying effective ways to curb tax abatement policies.

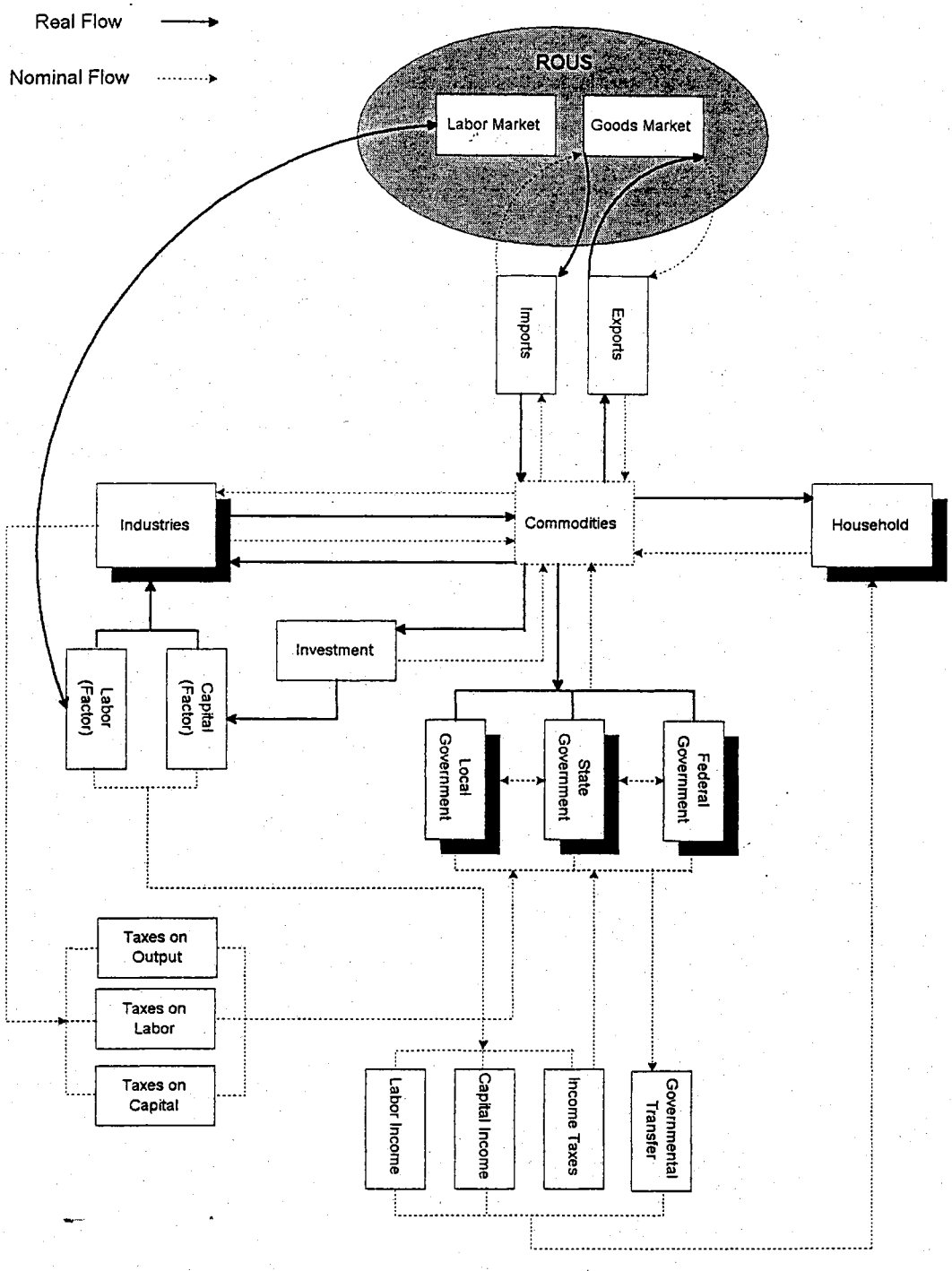


**Figure1: Overview of Ohio Computable General Equilibrium Model**

## Table 1: Aggregate Social Accounting Matrix (SAM) for Ohio, 1990

| | Ind | Com | L | K | H | G | S-I | ROW | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Industries (Ind)** | | 417709 | | | | | | | 417709 |
| **Commodities (Com)** | 180819 | | | | 157082 | 41812 | 35292 | 192296 | 607302 |
| **Labor (L)** | 149109 | | | | | | | | 149109 |
| **Capital (K)** | 71857 | | | | | | | | 71857 |
| **Household (H)** | | | 141654 | 42212 | | 34048 | | | 217914 |
| **Government (G)** | 15923 | | | 4511 | 40875 | 10170 | | | 71478 |
| **Saving-Investment (S-I)** | | | | 20445 | 19957 | -13555 | | | 26846 |
| **Rest-of-World (ROW)** | | 189593 | 7455 | 4690 | | -997 | -8446 | | 192296 |
| **Total** | 417709 | 607302 | 149109 | 71857 | 217914 | 71478 | 26846 | 192296 | |

**Table 2: Changes Induced by Experiment One - Job Tax Credit in Ohio with No Retaliation in ROUS[1]**

| | Aggregate | Goods-Producing Sector | Service-Producing Sector |
|---|---|---|---|
| Job tax credit | | $47 M (N/A) | |
| Real gross state product | $498 M (0.21%) | | |
| State government revenue | -$11 M (-0.05%) | | |
| State government expenditure | $38 M (0.13%) | | |
| Industry output | $1,347 M (0.32%) | $1,196 M (0.55%) | $151 M (0.08%) |
| Net investment | $441 M (1.45%) | $304 M (1.91%) | $138 M (0.95%) |
| Exports | $1127 M (0.59%) | $954 M (0.72%) | $173 M (0.29%) |
| Employment (workers) | 938 (0.02%) | 4,580 (0.28%) | -3,643 (-0.09%) |
| Annual real wage rate | $141 (0.55%) | $181 (0.55%) | $125 (0.55%) |
| In-migration (workers) | 746 (N/A) | | |

[1]Dollar values (except for wages) are in millions of 1990 dollars. Values in parentheses are percent changes from benchmark levels.

**Table 3: Changes Induced by Experiment Two - Job Tax Credit in Ohio with Retaliatory Effects in ROUS Labor Market[1]**

| | Aggregate | Goods-Producing Sector | Service-Producing Sector |
|---|---|---|---|
| Job tax credit | | $47 M (N/A) | |
| Real gross regional product | $72 M (0.03%) | | |
| State government revenue | -$100 M (-0.43%) | | |
| State government expenditure | $0.3 M (0.0009%) | | |
| Gross industry output | $112 M (0.03%) | $138 (0.06%) | -$26 M (-0.01%) |
| Net investment | $99 M (0.33%) | $106 M (0.67%) | -$7 M (-0.05%) |
| Exports | $ 167M (0.09%) | $175 M (0.13%) | -$8 M (-0.01%) |
| Employment (workers) | 46 (0.0008%) | 522 (0.03%) | -476 (-0.01%) |
| Annual real wage rate | $0 (0%) | $0 (0%) | $0 (0%) |
| In-migration (workers) | 0 (N/A) | | |

[1]Dollar values (except for wages) are in millions of 1990 dollars. Values in parentheses are percent changes from benchmark levels.

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## Endnotes

1. See Kraybill and Pai for a detailed description of the Ohio CGE model.

2. In contrast, the export base model assumes that the base/nonbase ratio is fixed.

3. The results of any regional model are influenced by the aggregate responsiveness of the model to shocks. Migration and investment are the key factors in the aggregate responsiveness of our model. We were uneasy with relying upon the wage rate-migration elasticity as the sole determinant of labor market responsiveness since it is widely known that migration is influenced by other factors, particularly employment opportunities. As a check on the labor responsiveness of our model, we imposed upon our model a migration/employment change ratio borrowed from Bartik (1990, 1991) and solved deterministically for the wage rate-migration elasticity. This allowed us to check whether our econometrically estimated wage rate-migration elasticity is consistent with the migration-employment change relationship found in other studies. Using this procedure, our calibrated wage-rate migration elasticity was 0.12, very close to our econometric estimate of 0.2.

4. In addition, the recipient firms promised to retain 12,500 existing jobs. These jobs were not included in the modeling scenario for two reasons: (1) Ohio's job tax credit legislation only allows tax credits for new jobs and (2) it is likely that many of the existing jobs that firms claimed to "retain" would have remained in Ohio without the tax credit.

5. The employment multiplier is implied rather than explicit here since our modeling scenario does not consist of a direct change in employment. The direct impact is the wage subsidy which lowers the wage costs of firms and induces them to hire more labor under the assumption of profit maximization.

6. In contrast, input-output (IO) employment multipliers generally range between 1.1 and 2.5, though many analysts believe that IO multipliers are unrealistically high since they are derived from a model with no factor constraints.

7. The increase in employment of Ohio workers could occur for several reasons: (a) a reduction in the officially unemployed, (b) a reduction in discouraged workers who had previously dropped out of the labor force, and (c) and the entrance of new workers into the laborforce. Theorists disagree on the determinants of regional unemployment and labor force participation.

8. Real expenditures of the state government remain constant in the model. In actuality, real state government expenditures are likely to increase, however, because of various grants (for infrastructure or structures) and loan subsidies given by state government to project firms in addition to the job tax credit.