Explaining the Type SAM multiplier

Type I Multiplier

A Type I multiplier is calculated by dividing the direct effect (produced by a change introduced by the user) plus the indirect effect (the additional economic activity from industries buying from other local industries) divided by the direct effect. The Leontief inverse (Type I multipliers matrix) is derived by inverting the "direct coefficients matrix". The result is a matrix of total requirement coefficients, the amount each industry must produce in order for the purchasing industry to deliver one dollar's worth of output to final demand.
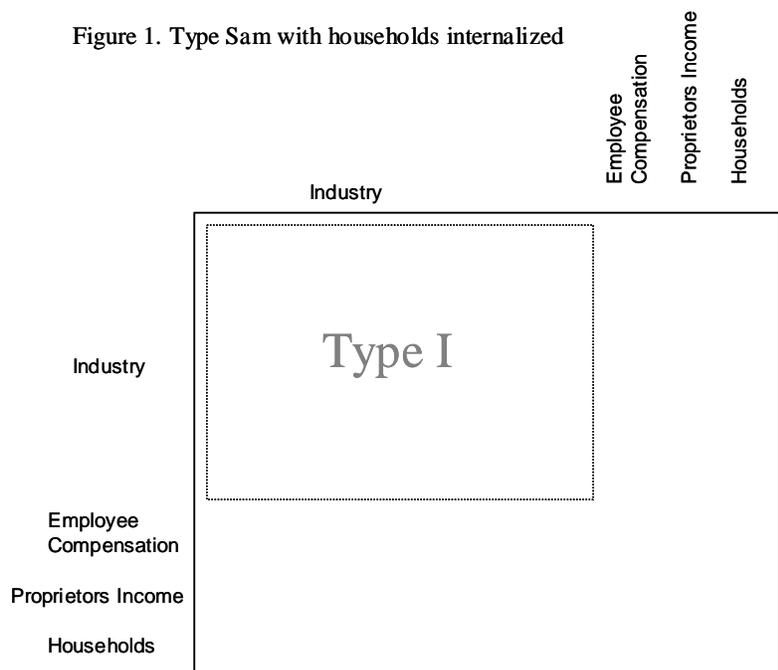
Type SAM multiplier

Type SAM (Social Accounting Matrix) multipliers are the direct, indirect (Type I) plus induced effects where the induced effect is based on information in the social account matrix. Theoretically, you could internalize any of the institutions (households, state and local government, Federal government, capital). When you internalize an institution you build into the SAM multipliers the activities of that institution. You are assuming that every dollar collected locally by that institution will be respent for that local institution's operations. You are also internalizing any inter-institution transfers.

Logical questions would be: Why are households default? And: When would I use any of the other institutions?

Type SAM with households internalized

The default multiplier formulation internalizes households. In a true SAM, for each column there is a corresponding row. The column "Households" shows the distribution of purchases made by households. The row "Households" receives income, which is necessary in order for the households column to have money to disburse. Since households receive income through labor income in the form of employee compensation or income from self-employment (proprietors income), we need to include these rows and columns as shown in figure 1 below.

Figure 1. Type Sam with households internalized

The inner box represents the industry interactions (ie, the Type I multiplier). The outer box encompasses the additional institutional transactions we are introducing with the Type SAM multiplier. With an impact triggered by new production, we have industries paying employee compensation and proprietor's income. Industries do not pay households directly. Instead, local households receive money from the employee compensation and proprietor's income columns. Note that employee compensation also pays money to the federal and state and local governments for social insurance and to "domestic trade" for those workers who in-commute – these are leakages as these

institutions are not internalized as part of this particular Type SAM multiplier formulation. The local households, in turn, use the income to buy locally produced goods and services which drive the induced effect. Note that local households will also pay government institutions (taxes, fees, licenses, etc) and domestic trade (imported goods and services) which are leakages and work to reduce the overall multiplier.

It is safe to assume that local workers will respend their labor income, so this type SAM formulation is generally accepted and in fact, either in this form or as the Type II multiplier (the traditional induced multiplier) make up the bulk of past impact analysis studies. This is the conservative "best practices" formulation.

This Type SAM multiplier has the advantage over the traditional Type II because the Type SAM recognizes the leakages caused by payroll payments for social insurance and in-commuters. The Type II multiplier assumes that each dollar of labor income goes to local households.

(What if I choose one or a couple household income classes?… to be answered later).

In discussing other Type SAM formulations, I will assume that the households will also be internalized.

Type SAM multipliers with State and Local Government internalized

Internalizing state and local government education and non-education assumes that these institutions will respend each dollar of local tax, fee, licenses, etc. collected locally for local programs. At the state level, this makes sense – state budgets are required to be balanced, so the more they collect the more they spend and vice-versa (the occasional state tax rebate complicates this but it tends to be the exception rather than the norm).

At the local level this becomes more problematic, while the locally collected tax dollar goes to the state general pot, the local region *tends* to receive equal money back. I place "tends" in italics because the occasional newspaper article pops up regarding a local legislator complaining that his district is not receiving its fair share of state revenue. Likewise a declining region will receive more than its fair share of unemployment compensation and economic development funds.

Figure 2. Type SAM with state & local government internalized
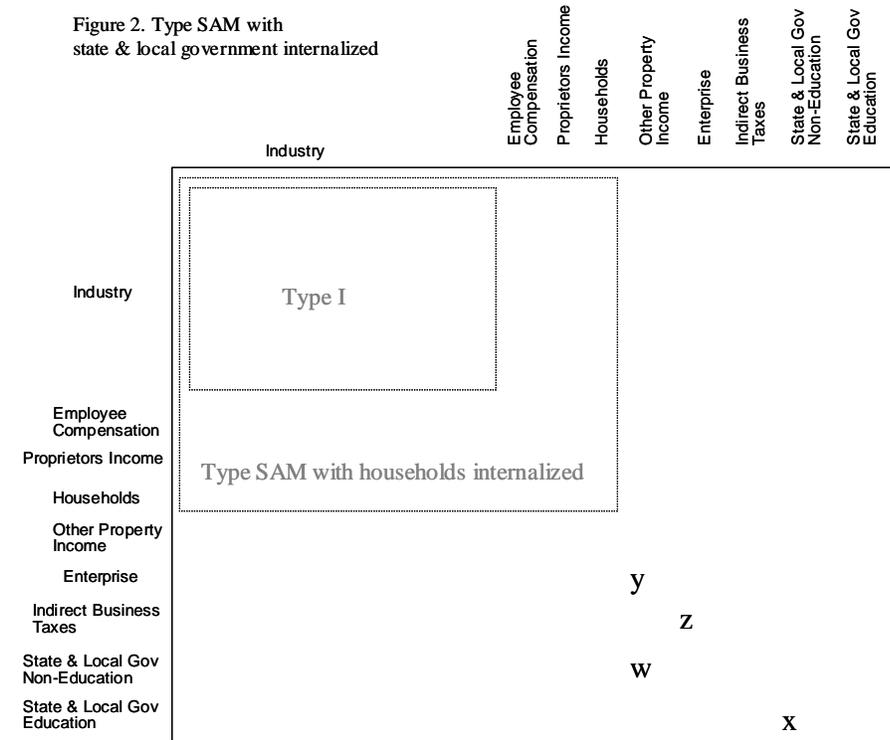
However, I have seen studies that increase state and local government expenditures externally (through introducing a final demand spending vector to the impact analysis) based on a percentage increase in employment or a calculated population growth. These users are making the assumption that government spending grows proportionately with the

local economy – which can be quite easily modeled in IMPLAN by internalizing state and local government non-education and education.

The best case scenario would be academic studies which tell us why/why not or in which situations internalizing state and local governments is a good idea. With an academic blessing we can safely use this Type SAM formulation as the conservative/best practices multiplier. *(Note: if you see such studies please send me a link: doug@implan.com)*

Figure 2 helps illustrate the mechanics of internalizing state and local government. First note that we have introduced "other property type income" (mostly corporate profits) and "enterprises" (mostly retained corporate profits). These have been included because for some states corporate taxes are an important source of government income. There is a direct transfer of interest (either net positive or negative) marked as "w" in figure 2 from other property type income to government. There is also a transfer from other property type income to enterprises (the source of retained earnings) – marked "y" in figure 2 and the transfer from enterprises to state and local government non-education (corporate income taxes) – marked "z" in figure 2.

Indirect business taxes are introduced, as it is one of the most important sources of income for state and local governments –eg, sales taxes, property taxes, licenses, etc. Note, personal income taxes – household payments to state and local government - are already part of the formulation.

If including one state and local government institution, it is almost necessary to include both non-education and education together in the formulation. First, a huge chunk of state and local non-education spending is an appropriation to education. In IMPLAN, only the non-education sector collects money so education is only funded by an appropriation and if internalized by itself would not add any impact to the induced effect. Without education a large portion of the non-education spending would be leaked.

What about **state and local government investment**? This is not as straightforward. While much of government investment is operational capital goods (trucks, computers, etc.), the really big projects (highways, buildings, stadiums) are funded through bonding and are not necessarily related to the current state of the economy. I am not aware of any studies where government investment is internalized as part of a Type SAM multiplier.

Type SAM multipliers with Federal Government internalized

Again, if you internalize Federal government you are assuming that each dollar of locally collected Federal taxes will be respent locally. About the only situation where I could safely justify internalizing both "Federal defense" and "Federal non-defense" is in a national model.

Many Federal non-defense services are based on population and some argument could be made to include it. But, the ability of more powerful representatives to direct appropriations make this assumption somewhat shaky at the local level.
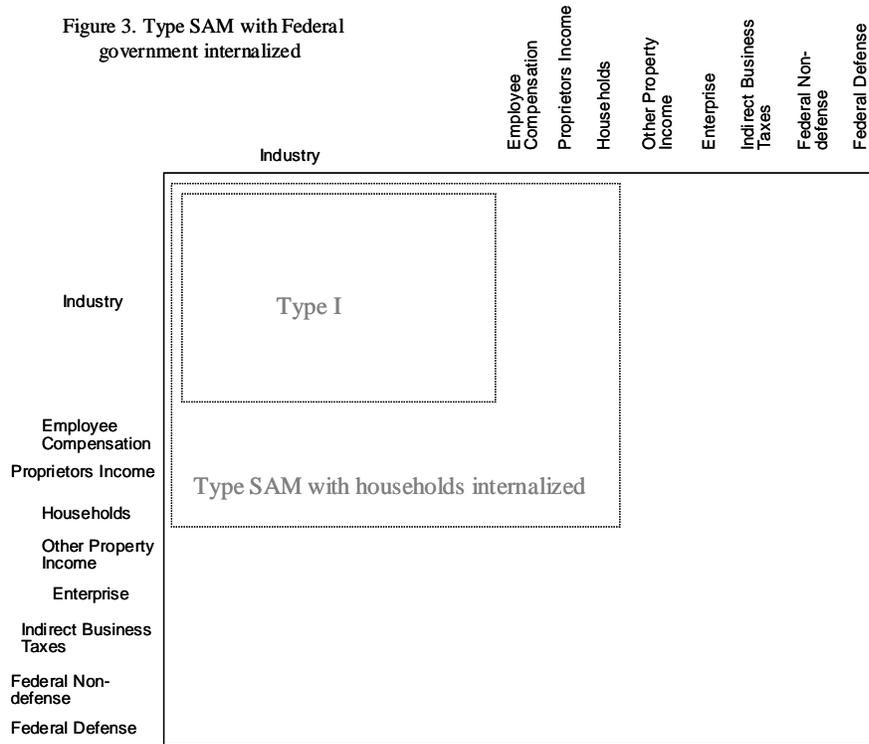
When it comes to Federal defense, a locally growing economy will cause little indirect or induced growth on the local military base.

The formulation of the type SAM multiplier with Federal Government internalized (figure 3) mirrors state and local government. Federal non-defense funding comes from taxes paid by households, indirect business taxes, corporate income taxes and net interest payments from other property income. One (increasingly) significant source of Federal funding is capital (borrowing). Federal borrowing is not linearly related to the economy, so it is not included as part of the type SAM multiplier. Similar to state and local education above, Federal defense is only funded by appropriation from Federal non-defense, so by itself would not add to the induced effect.

Internalizing **Federal government investment** is even more tenuous than state and local government investment. I believe that Federal investment will be more directly related to the party and seniority of the representative or occurrence of a disaster than local economic conditions.

My opinion is that local economic factors figure very little in Federal spending decisions, except to the extent that population (voters) grow and decline. Since a Federal response to a new local factory is unlikely, I cannot recommend internalizing any Federal institution.
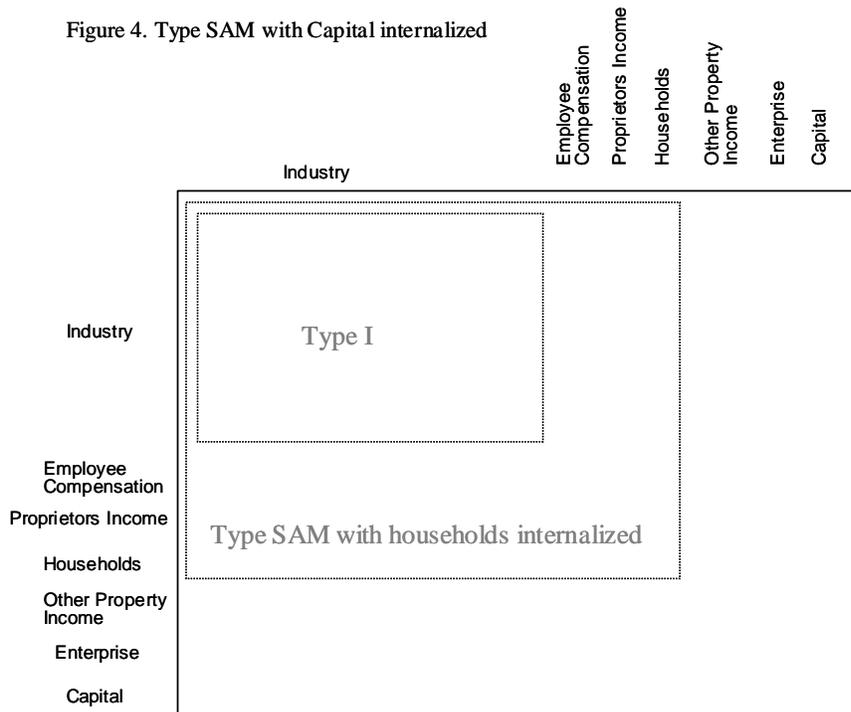
Figure 3. Type SAM with Federal
government internalized

Industry

Employee Compensation
Proprietors Income
Households
Other Property Income
Enterprise
Indirect Business Taxes
Federal Non-defense
Federal Defense

Industry

Type I

Type SAM with households internalized

Employee
Compensation

Proprietors Income

Households

Other Property
Income

Enterprise

Indirect Business
Taxes

Federal Non-
defense

Federal Defense

Type SAM multipliers with Capital internalized

Capital formation (purchase of new structures and capital equipment) is not part of any industry production function. These purchases are a separate institution forming one of the components of final demand. Final demand is the final

Figure 4. Type SAM with Capital internalized

Industry

Employee Compensation
Proprietors Income
Households
Other Property Income
Enterprise
Capital

Industry

Type I

Type SAM with households internalized

Employee
Compensation

Proprietors Income

Households

Other Property
Income

Enterprise

Capital

consumption of a good for the region – goods and services that are part of capital formation have met their ultimate use. Buildings and equipment are not remanufactured creating new value added (however, they can be resold as used goods).

Industry decisions to invest is based on local conditions and perhaps the business cycle. If conditions are correct, they will invest (a non-linear action) with the promise of using a future stream of increased value added to pay of f the investment.

What this means is that when you cause an impact, increasing the induced demand for restaurant output (for example), we get the employment, income and operational spending to run the restaurant but the multipliers do not incorporate any economic activity associated with the construction of the restaurant – if necessary.

Figure 4 shows the formulation of the type SAM multiplier with capital internalized. Sources of income for capital come from industries (in the form of sales of scrap and used goods), from households (in the form of sales of scrap and used goods and savings) and from enterprises (in the form of savings from other property income retained earnings).

As a region grows, you would expect investment to grow accordingly – but I would argue it is not based on local saving, but is a function of business cycle and how mature (how much of its infrastructure needs are in place) the region is. Also, this really could only possibly work in the growth direction. As a region declines, its savings decline which would force the multipliers to respond to negative investment.

The only rationale I can come up with for negative investment is the curb on growth excess capacity has on regional investment when the region starts to grow again.

The upshot is that this is interesting to talk about and is fertile ground for academic study, but I would not want to justify or interpret internalizing capital to a client.

Type SAM Multipliers with Enterprises (Corporations) Internalized

There is no real spending pattern for retained earning other than distribution to owners, government and savings. As such it is useful for internalizing those institutions and capital spending but not on its own. At the local level owners are quite likely to live outside of the region.

Type SAM Multipliers with Inventory Additions/Deletions Internalized

Change in inventory levels allow for calculating gross regional product and as balancing production with sales but have no real economic impact interpretation if internalized.